

# GPM Program Status at the BRAZILIAN SPACE AGENCY (AEB)

**Presented by: Raimundo Nonato Fialho Mussi**

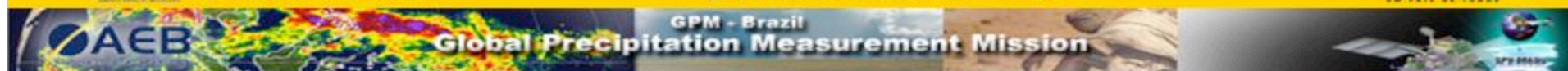




# The Brazilian Space Agency AEB



**The Brazilian Space Agency – AEB** is an independent institution linked to the Ministry of Science and Technology with the purpose of developing space activities of national interest

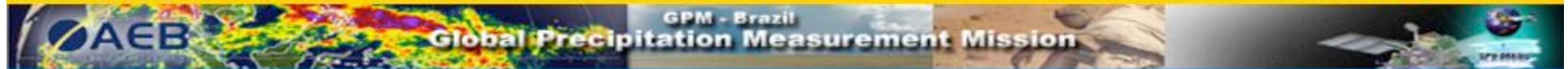


# The Brazilian Space Activities Program - PNAE

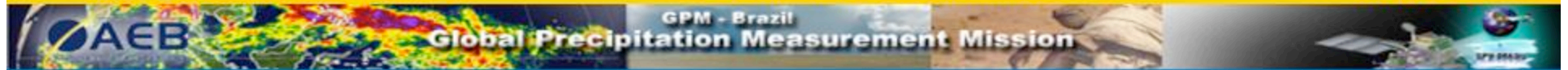


**The Brazilian Space Activities Program - PNAE** is established by the AEB to summarize the space activities with an horizon of ten years and is reviewed each two years



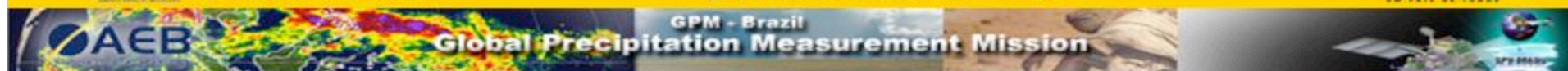


**The current PNAE covers the  
period 2005-2014**



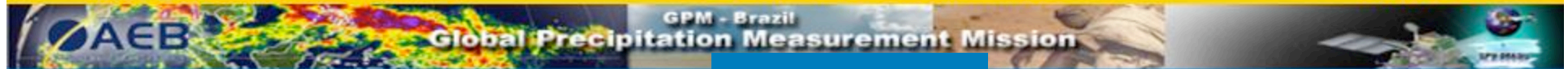
The main themes of the PNAE 2005-2014 are:

- Earth Observation
- Scientific and Technological Missions
- **Meteorology**
- Access to Space
- Telecommunications
- Research and development



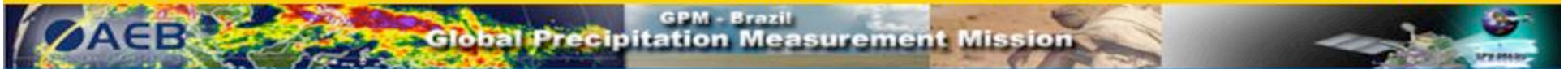
# GPM Brazilian Program

## GPM-Br



**The GPM Brazilian Program**  
GPM-Br was established by AEB with the aims at coordinating the actions of Brazilian institutions concerning the GPM and encouraging the use of the available data.





## **GPM Br – LANDMARKS**

**2004, MAY: THE BRAZILIAN SPACE AGENCY (AEB) ESTABLISHED THE GPM-BRAZIL (GPM-Br) PROGRAM**

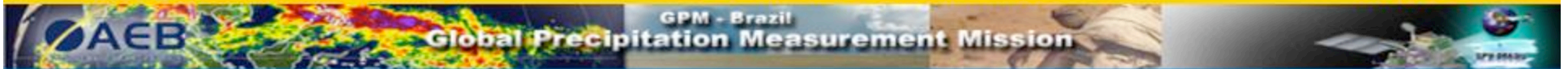
**2005: THE PNAE COVERING 2005-2014 - THE ACTIONS IN METEOROLOGY INCLUDES GPM MISSION**



## **GPM Br – STRUCTURE**

THE GPM-BR IS COORDINATED BY AEB  
AND HAS THE FOLLOWING STRUCTURE:

- EXECUTING INSTITUTIONS**
- COORDINATION COMMITTEE**
- MANAGEMENT OFFICE**
- PARTICIPANT INSTITUTIONS**
- ADVISERS**
- USERS**



## **GPM Br - STRUCTURE**

### **EXECUTING INSTITUTIONS**

**ARE THE INSTITUTIONS**

**CO-RESPONSIBLE FOR THE**

**IMPLEMENTATION OF THE GPM-BR**



# **GPM Br - STRUCTURE**

## **EXECUTING INSTITUTIONS**

- BRAZILIAN SPACE AGENCY - AEB**
- NATIONAL METEOROLOGY INSTITUTE – INMET**
- NATIONAL INSTITUTE FOR SPACE RESEARCHES – INPE**
- INSTITUTE OF ASTRONOMY AND GEOPHYSICS – UNIVERSITY OF SÃO PAULO – IAG/USP**
- BRAZILIAN ENTERPRISE FOR AGRICULTURE – EMBRAPA**
- NATIONAL AGENCY FOR WATERS – ANA**





## **GPM Br - STRUCTURE**

### **COORDINATION COMMITTEE**

**IS A BODY, COMPOSED BY  
REPRESENTATIVES OF THE  
EXECUTING INSTITUTIONS,  
RESPONSIBLE FOR OVER ALL  
COORDINATION OF THE GPM-BR**



## **GPM Br - STRUCTURE**

### **MANAGEMENT OFFICE**

**HEADED BY A MANAGER  
NOMINATED BY THE AEB'S PRESIDENT  
AND IS RESPONSIBLE TO IMPLEMENT  
THE ACTIONS OF THE GPM-BR**



## **GPM Br - STRUCTURE**

### **PARTICIPATING INSTITUTIONS**

**ARE THE INSTITUTIONS  
RESPONSIBLE FOR THE DEVELOPMENT  
OF GPM-BR'S  
SPECIFIC TASKS.**

# PARTICIPANT INSTITUTIONS - TASK STRUCTURAL MATRIX (\*)

Potential Participant Institution	AEB	EMBRAPA	IAG/USP	CPTC/INPE	INPE	POLI/USP	INMET	FUNCME	ANA	UNESP	UECE	CTA	SIPAM	UNIFEI	UNICAMP	PUC/RJ	UFRJ
Task																	
Coordination (National, and International Interfacing)	X																
Validation (Ground & Airborne)		X	X	X						X			X		X		X
Research (Science/ Algorithms)		X	X	X												X	
Sensors & Spacecrafts (Development and Operation)			X		X	X					X	X		X			
Data (Availability)				X		X	X	X	X	X							

\* Potential participants in the establishment of GPM-Br.

POLI - Polytechnics School/University of São Paulo  
 FUNCME - Ceará State Foundation of Meteorology and Hydrological Resources  
 ANA - Nacional Water Agency  
 UECE - University of the State of Ceará  
 CTA - Aerospace Technology General Command

SIPAM – Amazon Protection System  
 UNIFEI - Federal University of Itajubá  
 UNICAMP - University of Campinas (State of São Paulo)  
 UFC - Federal University of Ceará  
 UFRJ - Federal University of Rio de Janeiro  
 PUC/RJ – Catholic University/Rio de Janeiro  
 UNESP – University of São Paulo State



## **GPM Br - STRUCTURE**

### **ADVISERS**

**ARE SCIENTISTS AND TECHNICIANS  
REQUESTED TO ASSISTANT THE  
COORDINATION COMMISSION OR THE  
GPM-BR'S MANAGER**



## **GPM Br - STRUCTURE**

### **USERS**

**ARE INDIVIDUALS OR ORGANISATIONS  
THAT USE GPM DATA,  
ACCORDING TO RULES SET FORTH BY  
GPM-BR**

# **GPM Br - LINES OF ACTION**

## **COORDINATION**

**National and international interfacing**

## **VALIDATION**

**Ground and Airborne**

## **RESEARCH**

**Science and algorithms**

## **SENSORS AND SPACECRAFTS**

**Development and operation**

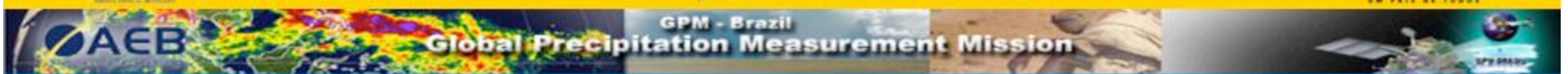
## **DATA**

**Availability and information**



## **COORDINATION**

- LIASON WITH GPM PROGRAM**
- INTERNATIONAL COOPERATION**
- STRENGTHEN NATIONAL PARTICIPATION**
- PROMOTION OF GPM DATA USE**



# **VALIDATION**

## **GROUND BASED OBSERVATIONS**

**THE FOLLOWING FIGURE SHOWS ONE OF THE PROPOSED VALIDATION SYSTEMS, WHICH WAS SUBMITTED TO THE NUCLEUS, TO PERFORM GROUND VALIDATION IN THE STATE OF SÃO PAULO**

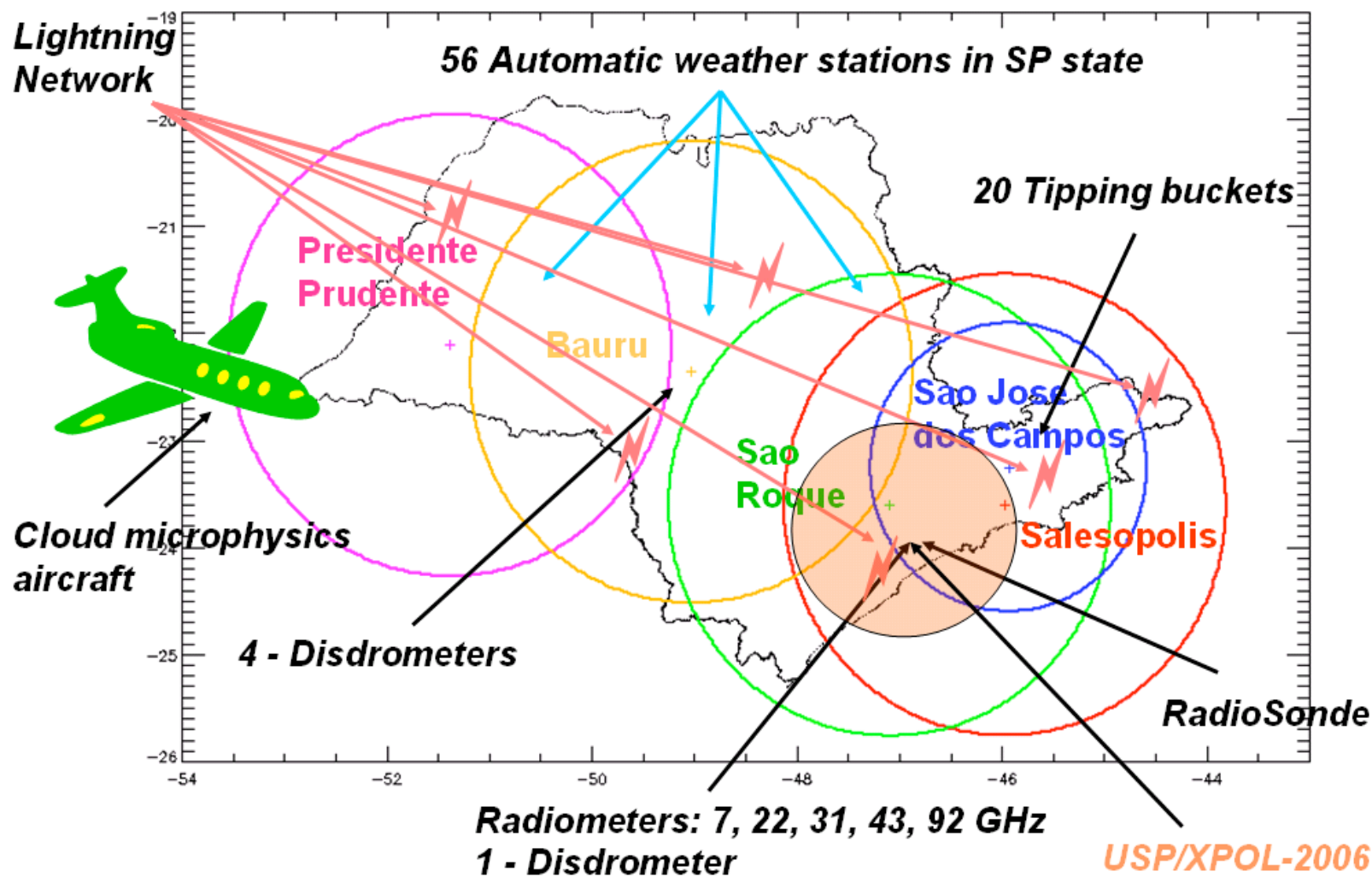
## **AIRBONE OBSERVATIONS**

**A PROMISING POSSIBILITY IS THE DEPLOYMENT OF THE NEW RESEARCH AIRCRAFT HALO (TYPICAL FLIGHT LEVEL 18KM), EQUIPED WITH MICROWAVE RADIOMETERS, TO PERFORM DEDICATED OBSERVATIONS FOR GPM VALIDATION, IN BRAZIL (SP).**



# MAIN GROUND VALIDATION SITE

(Proposal submitted to the GPM-Br Nucleus)





# SCIENCE AND ALGORITHMS

## BASIC & APPLIED RESEARCH

- RADIATIVE MODELS (INSIGHT IN ICE SCATTERING)
- SURFACE MICROWAVE RADIOMETRY
- CHARACTERIZATION OF THE PRECIPITATION OVER BRAZIL (INCLUDING DROP SIZE DISTRIBUTIONS, HYDROMETEORS DISTRIBUTIONS ALONG THE VERTICAL)
- STRATIFICATION OF Tb-z RELATIONSHIPS

## ALGORITHMS:

- PRECIPITATION ESTIMATES THROUGH COUPLING OF A RADIATIVE TRANSFER MODEL TO A WEATHER FORECASTING MODEL, WITH EXPLICIT CLOUD MICROPHYSICS.
- PRECIPITATION ESTIMATES THROUGH Tb-Z RELATIONSHIPS STEMMING FROM COMPARISONS OF SAME PROBABILITY LEVELS FOR BOTH VARIABLES

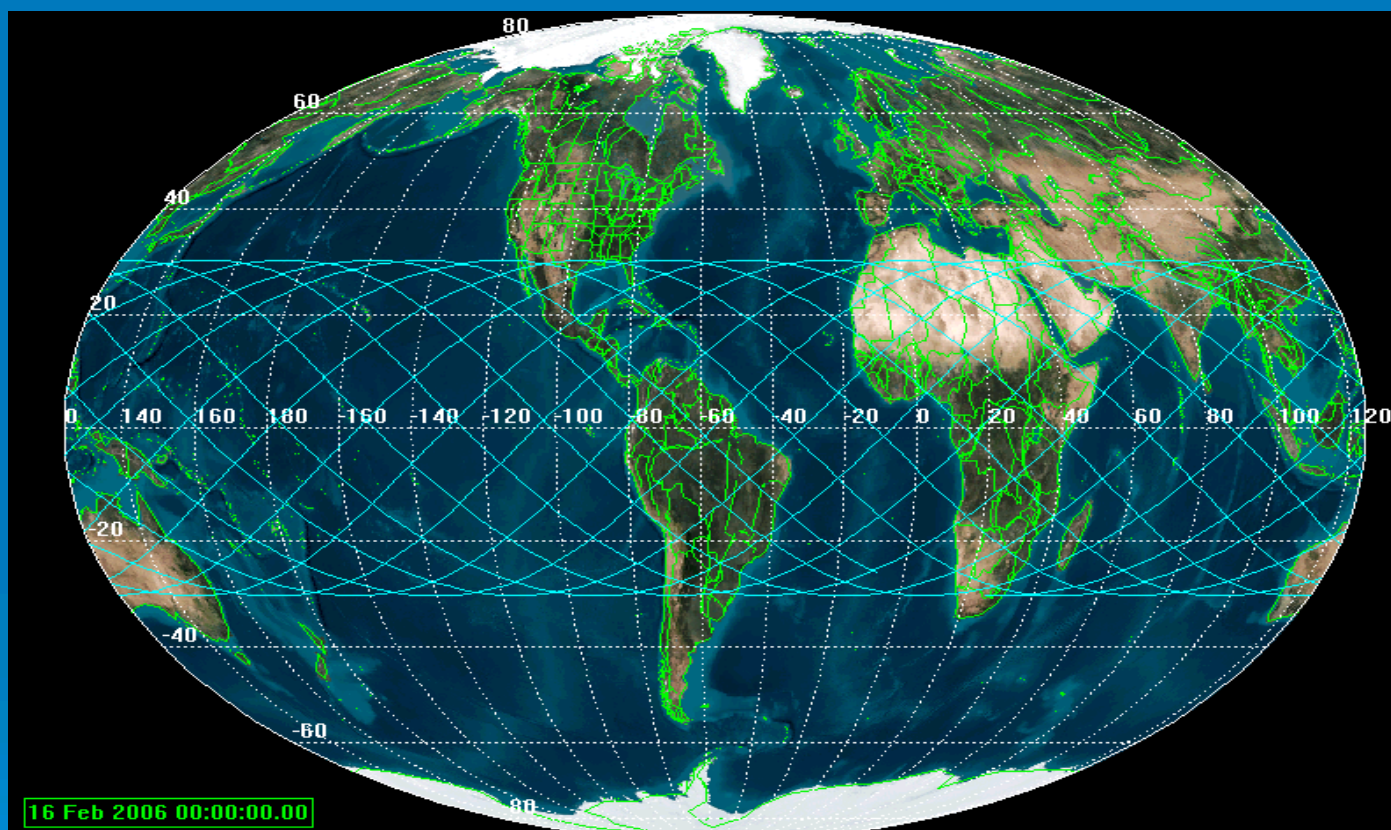


# **GPM-BR SATELLITE**

**IN HOUSE DEVELOPMENT OF A  
LOW EARTH EQUATIONAL ORBIT  
SATELLITE (30° INCLINATION,  
AND ~ 600 KM HEIGHT), USING  
THE INPE'S MULTI MISSION  
PLATAFORM, WITH CONICAL  
SCANNING**

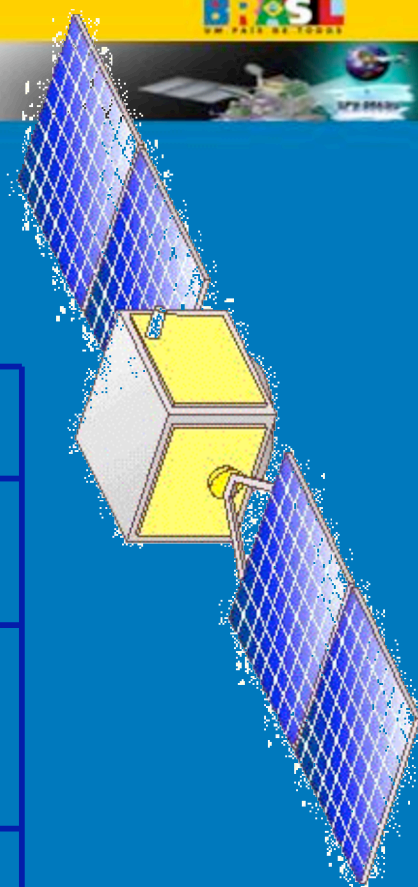


# GPM Br – Orbit Studies



# Multi-Mission Platform

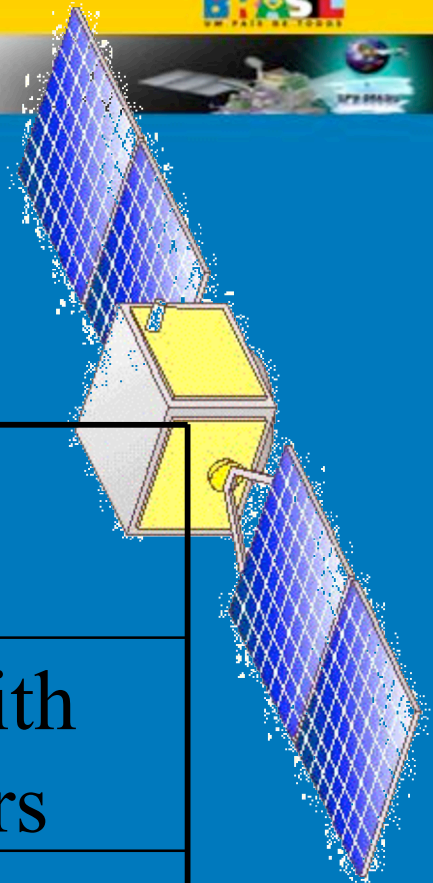
Mass	185 Kg
Power Consumption	150W
Available power for the payload	180W (80W during eclipse)
Orbit inclination	0 a 90
Orbit altitude	400 Km a 1500 Km
Stabilisation	3 axis





# Multi-Mission Platform

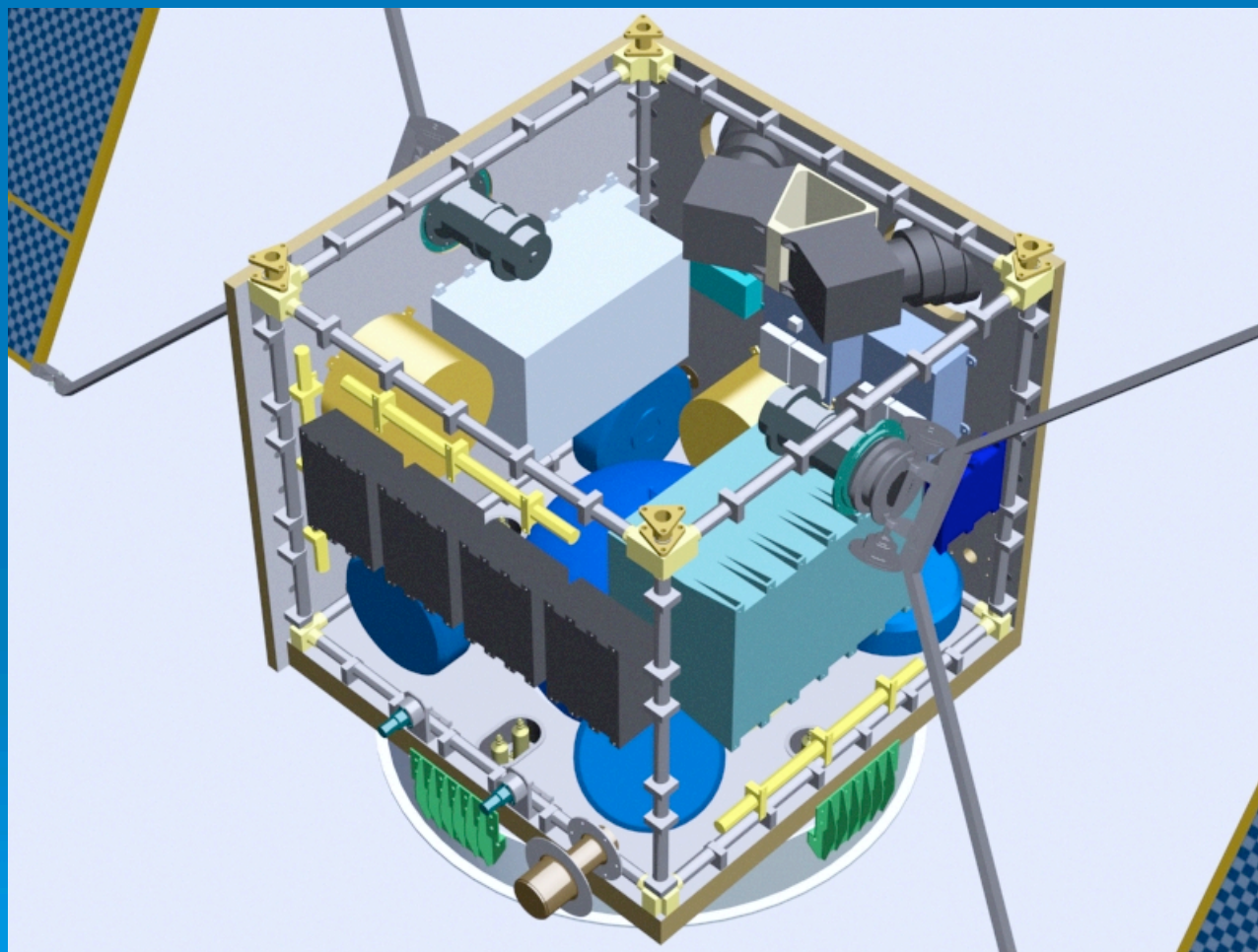
## Payload capacity



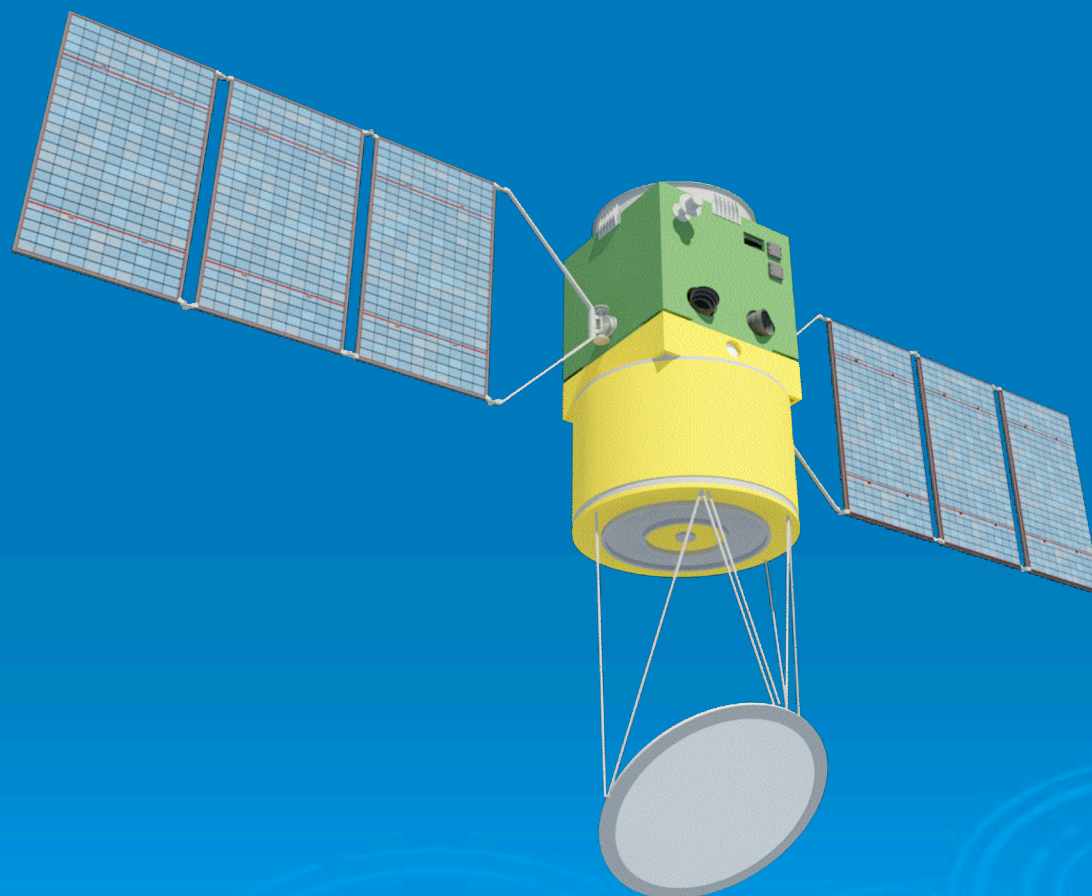
Mass	< 280 Kg
Volume	Compatible with class launchers
Power	175 W average 900 W peak
Orbit	Near equatorial and polar 600 to 1200 Km height



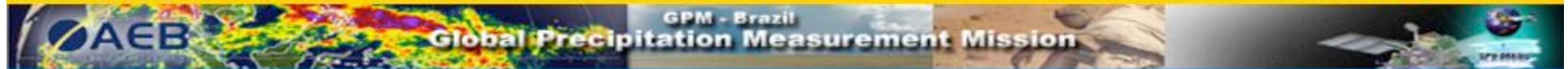
# PMM ARTISTIC CONCEPTION



# GPM SATELLITE PICTORIAL VIEW







# **SENSORS**

## **- IN HOUSE**

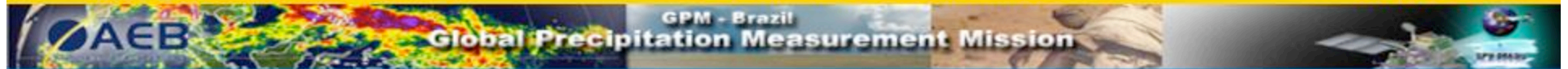
### **EXAMPLES:**

- RADIOMETER AT 92 GHz**
- RADIOMETER AT 89 & 150 GHz**
- DESIRABLE SPATIAL RESOLUTION 15 KM**

## **- PARTNERSHIPS**

### **EXAMPLE:**

- LIGHTNING DETECTOR BASED ON A BRAZILIAN DEVELOPED CCD CAMERA (WIFI ABOARD CBERS 3 & 4 SATELLITES)**
- DESIRABLE SPATIAL RESOLUTION 10 x 10 KM<sup>2</sup>**



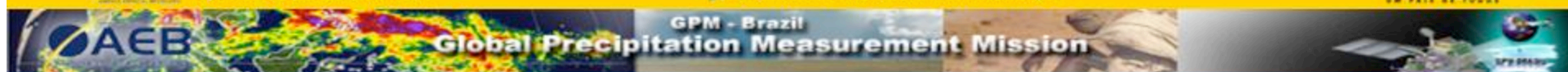
# DATA

**GPM RELEVANT DATA ACQUISITION AND/OR STORAGE EFFECTED THROUGH VALIDATION SUPPORT GROUP**

**GROUND BASED SYSTEMS EITHER DEDICATED OR SHARED WITH THOSE FOR OTHER PURPOSES WILL BE DEPLOYED/EXPLORED.**

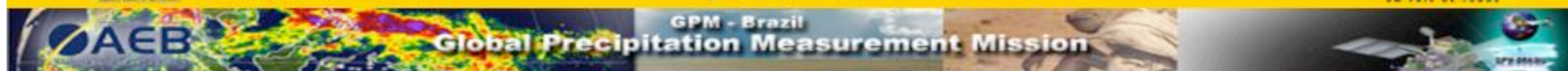
**THE SIHESP PROJECT (INTEGRATED HYDRO METEOROLOGICAL SYSTEM FOR THE STATE OF SÃO PAULO), PROVIDING EXTENSIVE COVERAGE BY WEATHER RADAR, IS ONE EXAMPLE OF SHARED OPERATIONS.**





# PHASES

- Implementation of partnerships within GPM through a basic validation project and a satellite in 2012,
- Survey of satellite demand, and specification.
- Development of radiative and applicative models to optimize satellite provided information.
- Development of surface microwave radiometry, for Air borne sensors and algorithm development.
- Establish the GPM-Br Network for data validation.
- Development and establishment of operational processes for reception, pre-processing, generation of applicatives, dissemination, and effective use of data and information.
- Satellite construction, integration & tests.
- Launching and making system operational.



# GPM Br – Home Page

Ministério da Ciência e Tecnologia

**GPM - BRASIL**  
Global Precipitation Measurement Mission

→ PLATAFORMA & INSTRUMENTOS → REDE DE OBSERV. & VALIDAÇÃO → DADOS → PUBLICAÇÕES

→ HOME GPM-BR → CIÊNCIA

**Missão GPM - Br**

**Eventos**

The 6th GPM International Planning Workshop

Global Precipitation Measurement: A Satellite Mission to Unify and Advance Global Precipitation Measurements

**Notícias**

Estamos disponibilizando o protótipo do folder GPM Br para Avaliação.

Sugestões e Críticas.

**Global Precipitation Measurement - GPM**

"A missão Medida da Precipitação Global faz parte da próxima geração de missões de Ciências da Terra baseada em satélites, que estudará a precipitação global (chuva, neve e gelo)."

**A IMPORTÂNCIA DA MEDIDA DA PRECIPITAÇÃO**

Um dos componentes críticos do ciclo hidrológico do planeta é a precipitação. A chuva é o elemento essencial na provisão da água potável que mantém a vida na Terra. As transformações da água no meio ambiente e a futura disponibilidade de fontes de água potável são motivos de grandes e recorrentes inquietações sociais em todo o planeta. Elas afetam virtualmente toda manifestação ambiental. Precipitação na forma sólida como neve e gelo frequentemente criam condições de risco durante tempestades de inverno. Nevascas bloqueiam as malhas rodoviárias e paralisam temporariamente as economias regionais... [Leia Mais](#)

**GPM e GPM-Br**

O Programa Internacional de Medidas de Precipitação (*Global Precipitation Measurement*) – GPM é um programa, desenvolvido pela *National Aeronautics and Space Administration* – NASA e pela *Japan Aerospace Exploration Agency* – JAXA (ex-NASDA) e aberto à participação internacional, por meio de agências espaciais e meteorológicas, que visa a monitorar globalmente, por meio de satélites, as precipitações na atmosfera, em alta resolução temporal... [Leia Mais](#)

**Histórico do GPM-Br**

Breve histórico da implementação do GPM - Br

**Precipitação por Satélite**

Histórico do desenvolvimento de métodos para estimativa de precipitação utilizando satélites meteorológicos.

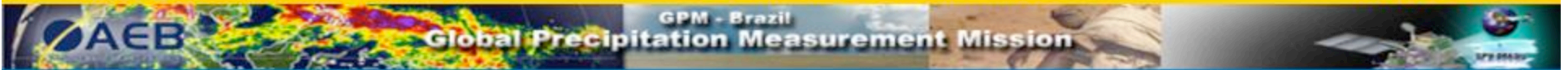
**CCO GPM-Br**

Datas de reuniões e Atas

**Status**

Em Construção.

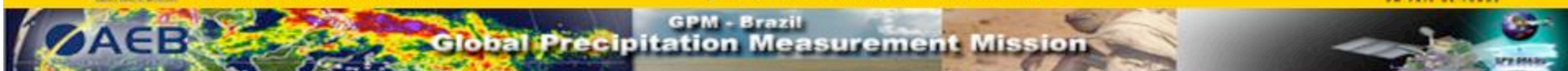
<http://www.aeb.gov.br>



# GPM Br INFORMATION

FURTHER INFORMATION ABOUT  
GPM-BR COULD BE FIND IN THE  
MANAGEMENT OFFICE.

[loiva@aeb.gov.br](mailto:loiva@aeb.gov.br)



THANK YOU !